Two new species of *Pelargonium* (Geraniaceae) from the Western Cape

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Received 6 June 1994; revised 22 August 1994

*Pelargonium curviandrum* E.M. Marais and *P. triandrum* E.M. Marais are described as new species. Both are tuberous species, belonging to the section *Hoarea* (Sweat) DC. They correspond in respect to their leaf structure, the colour and shape of the petals and the markings on the posterior petals. Both species have long protruding stamens which are curved upwards during anthesis. A description of the pollen morphology and the leaf anatomy, a distribution map, as well as an illustration of each species, are provided together with a discussion of their relationships within section *Hoarea*.

*Pelargonium curviandrum* E.M. Marais and *P. triandrum* E.M. Marais word as nuwe spesies beskryf. Afwes is gelaat wat aan die seksie *Hoarea* (Sweat) DC. behoort. Morfologies toon die twee spesies ooreenkomste wat betref die blaastruktuur, die kleur en vorm van die kroonblaare en die merke op die agterste twee kroonblaare. Albei spesies het lang meeldrade wat by die bloem uitstreek en opwaarts buig gedurende anthese. ’n Beskrywing van die stuimmeermorfologie en blaarantatomie, ‘n verspreidingskaart sowel as ‘n illustrasie van elke spesie word voorsien saam met ’n bespreking van hul verwantskappe binne die seksie *Hoarea*.

Keywords: Geraniaceae, *Hoarea*, new species, *Pelargonium*, southern Africa

Introduction

*Pelargonium curviandrum* E.M. Marais and *P. triandrum* E.M. Marais are deciduous geophytes belonging to the section *Hoarea* (Sweat) DC. The first known collections of *P. curviandrum* were made by R.H. Compton in 1931 and W.F. Barker in 1932, and of *P. triandrum* by M.A. Pocock in 1923. Since then only a few collections of any of these species have been recorded. Both species flower from October to November, usually after the leaves have died, thus herbarium specimens are usually without leaves. Proper herbarium specimens were prepared from plants collected in the field and grown in the garden. Leaves and flowers were collected at different stages.

*Pelargonium curviandrum* E.M. Marais, sp. nov. in section *Hoarea*. *P. punctato* affixe.


**Synopsis:**—Cape Province: 12 km E of Vanwyksdorp, *Lavranos* 20941 (STE, hol.; BOL, K, MO, NBG, PRE).

A deciduous geophyte with a small regularly shaped subterranean tuber, 100–300 mm tall when in flower. *Tuber*: a turnip-shaped or elongated root with a short flattened stem, covered with dark brown periderms, 15–50 mm long and 12–25 mm in diameter. *Leaves*: radial, hysteranthous, rosulate, simple, green, petiolate; lamina ovate, apex obtuse, base cuneate to truncate, margin crenate, 25–80 x 20–60 mm, adaxially covered with long glandular hairs interspersed with very long soft patent non-glandular hairs, abaxially velutinous interspersed with long glandular hairs; petiole 10–55 mm long and 2–4 mm in diameter, prostrate, covered with short glandular hairs and long soft patent non-glandular hairs; stipules subulate, adnate to petioles for half of their length, 4–8 x 1–2 mm, ciliata, apices laterally curved.

*Inflorescence*: scape 30–200 mm long, 1–3 mm in diameter, branched, bearing 2–4(–6) pseudo-umbellets with 7–23(–29) flowers each; peduncles 50–120 mm long, 1–2 mm in diameter, covered with short glandular hairs interspersed with long soft patent non-glandular hairs; bracts narrowly triangular, 4.5–5 x 1–1.5 mm, hisutae; flower buds, flowers and fruits erect. *Pedicel* ca. 0.5 mm long. *Hypanthium* 18–30 mm long, reddish brown, sparsely covered with short glandular hairs and non-glandular hairs. *Sepals* 5, lanceolate, apices acute, 7–12 x 1.5–3 mm, patent, reddish brown with white margins, indumentum abaxially as on peduncle. *Petals* 5, white to cream-coloured, patent during anthesis; posterior two with wine-red feather-like markings, ligulate, bases cuneate, apices rounded, 17–23 x 2.5–3 mm; anterior three narrowly spatulate, bases attenuate, apices rounded, 12–15 x 2.5–3 mm. *Stamens* 10, basally connate, staminal column 1.5–3.5 mm long, white, smooth; perfect stamens 4, lateral two 11–18 mm long, anterior two 13–20 mm long, protruding from the flower, curved upwards during anthesis, white; staminodes 2.5–6 mm long; anthers wine-red, 2–2.5 mm long, pollen orange. *Gynoeceum* lengthens conspicuously during anthesis; ovary superior, oblong-conical, 3-lobed, 3.5–5.5 mm long, densely sereous; style filiform, 6–12 mm long, white; stigma with branches, 0.5–1 mm long, adaxially pink. *Fruits*: a schizocarp consisting of 5 mericarps, bases of mericarps 5–6 mm long, with glandular hairs, tails 22–25 mm long. (Figure 1).

Diagnostic features

*P. curviandrum* is a geophyte with simple prostrate leaves, of which the older ones are bigger than the younger ones. The long and narrow ligulate petals are white to cream-coloured and as a result of the orientation of the two posterior petals the feather-like markings on them appear as a unit. *P. curviandrum* has four fertile stamens (11–20 mm long) which are more or less 1.5 times the length of the sepals (7–12 mm) and protrude from the flower. The flower is protandrous and the stamens are initially bent upwards during anthesis, hence the specific epithet *curviandrum*. Later on the anthers are dropped and the filaments bend...
downwards. At the same time the gynoecium lengths and the stigma finally takes up the original position of the anthers.

**Geographical distribution and ecology**

*P. curviandrum* occurs in the southern Cape on the mountain ranges between the 33 and 34° latitudes, from Montagu in the west to Oudtshoorn in the east (Figure 2), an area with an annual rainfall of 100–200 mm. It grows in mountain fynbos or in a vegetation dominated by *Porumbacaria atra* (spekboomveld) and usually occurs in very small populations. The peak of the flowering time is from October to November.

**Material studied**

—3320 (Montagu): 8 km N of Montagu (-CA), Hall 2117 (NBG); Joubertskop (-DA), Van Jaarsveld 10324 (STEU).
—3321 (Ladismith): Huissrivier Pass, Matjiesvlei turnoff (-BC), Marais 168 (STEU); Roodeberg, Ladismith (-CB), Compion 3894 (BOL); 12 km E of Vanwykskloof (-DA), Lavranos 20947 (BOL, K, MO, NBG, PRE, STE).
—3322 (Oudtshoorn): Bakenskraal, 12 km S of Oudtshoorn (-CA), Barker 67 (BOL, K).

*Pelargonium triandrum E.M. Marais, sp. nov. in sectione Houtreea distinta proper stramina fertilia solum tria, P. punctato affine.*

*Herba perennis acaulescentes tuberosa. Tubera subterranea, napi­forme, interdum moniliforme, 20–60 mm longum, 10–15 mm in diam. Folia hysterantha, rosulata, viridia, petiolata; lamina ovata, crenata, 15–75 mm longa, 15–65 mm lata, adaxiale et abaxiale pilosa et glandulosa; petioli 14–80 mm longi, prostrati, pilosi et glandulosi; stipulae petiolo adnatae. Infloroscentia: scapae pseudo­dumbellis 2–4(–7), utraque 7–26(–30) floribus. Pedicellum ca. 0.5 mm longum, Hypanthion 23–32 mm longum, glandulosum et parsim hirsutum. Sepala 5, lanceolata, 7–11 mm longa, 1–3 mm lata, una posterius erecta, cetera patentia. Petala 4, cremea vel pallida flavia, duas postica ligulata vel unguiculata spatulata, subtiliter sericea, 4–5 branches, 14–80 mm longae, white, smooth; staminodes 2–5 mm longi, adaxialiter hirsuta. Stamina fertilia 3, unicum anteriorem 20–30 mm longum, staminodia 5.

**TYPUS.—Cape Province: 27 km N of Citrusdal on old road to Clanwilliam, at turnoff to Algeria Forestry Station, Van der Walt & Vorster 1276 (STEU, holo.; BOL, K, MO, NBG, PRE).**

A deciduous geophyte with a small regularly shaped subterrane­an tuber, 100–200 mm tall when in flower. *Tuber*: a turnip-shaped or elongated, sometimes moniliform root with a short flattened stem, covered with flaking dark brown periderms, 20–60 mm long and 10–15 mm in diameter. *Leaves*: radical, hysteranthous, rosulately, simple, green, petiolate; lamina broadly ovate, apex rounded or obtuse, base cuneate, truncate or cordate, margin irregularly crenate, 15–50 × 15–65 mm, adaxially and abaxially densely pilose and densely covered with glandular hairs; petiole 14–80 mm long and 1–4 mm in diameter, prostrate, densely pilose interspersed with long and short glandular hairs; stipules subulate, adnate to petioles for half their length, 10–14 × 1–2 mm, ciliate, apices laterally curved. *Inflorescence*: scape 20–90 mm long, 2–4 mm in diameter, branched, bearing 2–4(–7) pseudo­umbellets with 7–26(–30) flowers each; peduncles 30–90 mm long, 1.5–2 mm in diameter, covered with glandular hairs interspersed with patent non-glandular hairs; bracts lanceolate, 5–7 × 1–2 mm, abaxially hirsute; flower buds, flowers and fruits erect. *Pedicel*: ca. 0.5 mm long. *Hypanthion*: 23–32 mm long, straw-coloured to pale reddish brown, indumentum as on peduncle. *Sepals*: 5, lanceolate, apices acute, 7–11 × 1–3 mm, posterior one erect, others patent, pale reddish brown with margins white, indumentum axially as on peduncle. *Petals*: 4, cream-coloured to pale yellow, patent during anthesis; posterior two with wine-red feather-like markings, ligulate to unguiculate-spataulate, bases cuneate, apices emarginate, 19–25 × 3–5.5 mm; anterior two narrowly spathulate, bases attenuate, apices rounded, 9.5–17 × 2–3 mm. *Stamens*: 8, basally connate, stamen column 1.5–3 mm long, white, smooth; perfect stamens 3, protruding from the flower, curved upwards during anthesis, lateral two 11–21.5 mm long, anterior one 20–32 mm long, white; staminodes 2–5 mm long; anthers dark pink, 1.5–2 mm long, pollen orange. *Gynoecium*: lengths conspicuously during anthesis; ovary superior, oblong-conical, 4.5–lobed, 3–4.5 mm long, densely sericeous; style filiform, 3.5–10 mm long, white to pale pink; stigma with 4–5 branches, 0.3–0.5 mm long, adaxially dark pink. *Fruit*: a schizocarp consisting of 4–5 mericarps, bases of mericarps 4 mm long, without glandular hairs, papillate at distal end, tails 23–32 mm long. (Figure 3).

**Diagnostic features**

*P. triandrum* is characterized by the reduced number of filaments (eight) and only three very long fertile stamens, hence the specific epithet. An androecium, comprising eight filaments only is known from a small distribution area along the Olifants River, south of Clanwilliam. Recently it was also collected in Hartnekskloof on the Ceres-Karoo side of the escarpment (Figure 2). This area receives an annual rainfall of 100–200 mm occurring mainly in winter. *P. curviandrum* occurs in broken succulent veld or dry fynbos on sandstone. Plants grow amongst rocks in red loam or under bushes in partial shadow or in direct sunlight and are usually locally abundant. It flowers from late October to November.

**Material studied**

—3218 (Clanwilliam): Clanwilliam (-BB), Hall NBG719152 (Figure 2) Known geographical distribution of *P. curviandrum* (a) and *P. triandrum* (b).
Figure 3 Pelargonium triandrum. A. Flowering plant ×1. B. Plant with leaves ×1. C. Petals ×1.5. D. Androecium ×2. E. Gynoecium ×3. F. Sepals ×1.5.
(NBG); Van Niekerk s.n. (STEU); 3 km S of Clanwilliam on grav­
elled road (–BB), Marais 304 (STEU); Ramskop Nature Reserve,
Clanwilliam (–BB), Van der Walt 1278 (STEU); 20 km from Algeria
to Clanwilliam (–BB), Van der Walt s.n. (STEU); Rondegat, 25 km S
of Clanwilliam (–BD), Friedrich 452 (STEU); Kriedouwkrantz (–
BD), Leighton 3346 (BOL), Pocock 777 (PRE); Ofifannstriver, at
turnoff to Algeria (–BD), Van der Walt s.n. (STEU). Van der Walt &
Vorster 1276 (BOL, K, MO, NBG, PRE, STE).

—3219 (Wuppertal): Hartnekskloof, Ceres Karoo (–DC), Van Zyl
s.n. (STEU).

Leaf anatomy
Leaf anatomical studies were performed on fresh material from
plants growing in the garden for more than one season (Table 1).
This ensured that all the material studied was from plants grow­
ing for a considerable time under similar conditions. Transverse
sections of wax-embedded petioles and laminae of both species
were cut with a rotary microtome and stained with Alcian Green
Safranin (Joel 1983). Sections were made through the middle
parts of the petioles and laminae.

The petioles of both *P. curviandrum* and *P. triandrum* are cir­
cular to adaxially flattened in transverse section. In both species
the petioles are covered by a uniserial epidermis with short or lon­
g and short glandular hairs and long soft unicellular non-gland­
lar hairs. The cortex comprises a uniseriate collenchymatous
idioblasts with druses are scattered through the pith, usually in
the vicinity of the vascular bundles.

The laminae of both species are amphistomatic with a uniseri­
el epidermis covered by a thin and smooth cuticle. The abaxial
epidermal cells are smaller than those of the adaxial epidermis.
The leaves are dorsiventral with adaxially only one layer (*P. tri­
andrum*) or two to three layers (*P. curviandrum*) of broad palis­
sade cells. The cells of the outer layer are longer than those of the
inner layer. The spongy tissue has larger intercellular spaces than
those found in *P. aciculatum* E.M. Marais and related species
which also belong to section *Hoarea* (Marais 1991). Druse
crystals occur usually on the border between the palisade and spongy
tissues.

Pollen morphology
Pollen grains of both *P. curviandrum* and *P. triandrum* were col­
cected from fresh material as well as herbarium specimens (Table 1)
and were treated according to the acetolysis method and stud­
ed with the light and scanning electron microscope. At least
twenty-five pollen grains of each specimen were studied and
measured (Table 1). The morphology of the pollen grains corre­
sponds to that of the rest of the genus *Pelargonium*, in that the
grains are spherical and tricolporate (Marais 1990). In *P. curvi­
drum* the tectum can be described as striate-reticulate (Borten­
schläger 1967; Figure 4a) because the main muri are on a higher
level and are more or less parallel to one another. In *P. triandrum*
the tectum can be described as extremely striate (Marais 1994)
because the main parallel muri are thicker and more prominent
than the lower connecting ones forming smaller lamina than those
of *P. curviandrum* (Figure 4). The pollen grains of *P. curvi­
drum* (73–76 μm in diameter) are more or less similar in size to
those of *P. triandrum* (70–85 μm in diameter).

**Discussion**
Both *P. curviandrum* and *P. triandrum* have very long protruding
stamens which are curved upwards during anthesis. This charac­
ter of the androecium is shared with *P. oblongatum* Harv. (Van
der Walt 1977) and *P. punctatum* (Andr.) Willd. (Van der Walt &
Vorster 1981), both of them belonging to section *Hoarea*. The
leaves of these four species are also very similar. All of them
have simple prostrate leaves with the older ones bigger than the
younger ones. The indumentum of the leaves, scapes, peduncle
and hypanthia of the different species is also very similar, com­
prising different combinations of long and short glandular hairs
and long soft patent non-glandular hairs. The non-glandular hairs
are usually very long.

All four species have branched scapes with 2–7(–8) pseudo­
umbellets, and although *P. oblongatum* [4–8(–24)] does not have
a similar large number of flowers per pseudo-umbellet as the oth­
ers (*P. curviandrum*, 7–23(–29); *P. triandrum*, 7–26(–30); *P.
punctatum*, 10–17–45(–60)), all of them can be regarded as

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Table 1 Specimens studied for pollen morphology and leaf anatomy
The colour of the flowers of the different species vary from pale yellow, cream-coloured or white with wine-red feather-like markings on the posterior petals. There is, however, a difference in the shape and the size of the petals. *P. oblongatum* has unguiculate-obovate to widely unguiculate-obovate petals, whereas those of *P. curviandrum, P. triandrum* and *P. punctatum* are ligulate to narrowly spathulate and as a result of the orientation of the posterior petals of the latter three species, the feather-like markings on them appear as a unit (Marais 1994).

Although all four species have very long protruding stamens, there is a difference in the structure of the androecium. Both *P. curviandrum* and *P. oblongatum* have ten filaments of which, in the case of *P. oblongatum*, only five bear anthers and in *P. curviandrum* only four (Figure 1). This structure fits in with the androecium of the genus (Marais 1994). Both *P. punctatum* and *P. triandrum* have a reduced number of filaments as well as fertile stamens; with seven filaments and two fertile stamens in *P. punctatum* or eight filaments and three fertile stamens in *P. triandrum* (Figure 3). A further resemblance between *P. curviandrum* and *P. oblongatum* is that both of them have a striate-reticulate pattern of the tectum of the pollen grains (Figure 4A), and this pattern differs from the extremely striate pattern occurring in *P. punctatum* and *P. triandrum* (Figure 4B). The size of the pollen grains in *P. curviandrum, P. oblongatum* and *P. triandrum* fits within the range of 70–85 μm in diameter, but in *P. punctatum* the size is much smaller (57–60 μm in diameter; Marais 1994).

*P. punctatum* and *P. triandrum* sometimes show a reduction in the number of carpels also, and can have a four- or five-lobed ovary. *P. curviandrum* and *P. oblongatum* always have five-lobed ovaries. *P. punctatum* (0.3–0.5 mm), *P. triandrum* (0.3–0.5 mm) and *P. curviandrum* (0.5–1 mm) have very short stigma branches, whereas the length of the stigma branches of *P. oblongatum* (1.2–2.5 mm) resembles that of the majority of species in section *Hessea* (Marais 1994). In all four species there is a marked lengthening of the style during anthesis.

All four species occur in the winter rainfall region, in areas with an annual precipitation of less than 300 mm, and although all of them grow under rather harsh conditions, the leaves exhibit no xeromorphic characteristics. The prostrate simple leaves are short-lived, appearing in April or May after the raining season has started, and die before flowering time in October or November. No sclerenchymatous tissue occurs on the periphery of the vascular cylinder of the pedicles and very little mechanical tissue occurs around the veins of the laminae. The spongy tissue has large intercellular spaces. In respect of the leaf anatomy, only *P. triandrum* reveals a slight difference from the others by having only one layer of palisade tissue on the adaxial side of the mesophyll, whereas the others have two to three layers. Although the number of palisade cell layers is a variable character which is easily influenced by environmental conditions (Cutler 1978), it must be kept in mind that the material studied here grew under similar conditions for more than one season.

The distribution areas of the four species do not overlap. *P. oblongatum* occurs in Namaqualand and the Richtersveld, north of the 31° latitude (Van der Walt 1977; Marais 1994), *P. triandrum* on the western side of the Cederberg, between 32 and 33° S (Figure 2), *P. punctatum* occurs more to the north than *P. triandrum* (between 31 and 32° S) on the eastern side of the escarpment (Van der Walt & Vorster 1981; Marais 1994), and *P. curviandrum* occurs on the mountain range in the southern Cape (Figure 2). All of them are often found in dry fynbos on sandstone.

The petals of *P. curviandrum* are similar to those of *P. triandrum* and *P. punctatum*, but the structure of the androecium and the pollen morphology of *P. curviandrum* reveal a closer relationship to *P. oblongatum*. The four species referred to here, exhibit many morphological similarities, but because of the differences in the structure of the tectum of the pollen grains, these similarities should rather be ascribed to convergent evolution than a phylogenetic relationship.

**Acknowledgements**

I am indebted to Mr E.G.H. Oliver for translating the diagnoses into Latin. Ellaphie Ward-Hillhorst for executing the water colour paintings which are reproduced with the kind permission of The Brenthurst Library (copyright) and to the Research Fund of the University of Stellenbosch for financial support.
Reference


